Minnesota Department of Natural Resources
Division of Forestry

FOREST INSECT & DISEASE NEWSLETTER

May 27, 2005

Ready …. Set ….. MUNCH!

Pine shoot beetle quarantine

A new bug has come to town and it's creating quite a because of the effect of the federal and parallel state quarantines on trade.

After the common pine shoot beetle (PSB), *Tomicus piniperda*, was found in Anoka, Dakota and Ramsey counties, the USDA Animal and Plant Health Inspection Service (APHIS) placed a federal quarantine on the state. The MN Dept.of Agriculture immediately placed an emergency parallel quarantine on the 3 infested counties, which temporarily alleviated the need to quarantine the entire state. Now they are proposing to replace the emergency PSB quarantine with a permanent quarantine on the same three counties.

That means that anyone moving pine wood or raw pine wood products out of or through those three counties during certain times of the year must obtain a compliance agreement from APHIS before moving the wood. An attempt is made to limit the impact so trade and wood transport are not hampered. But generally, the regulations add to the cost of moving the wood from point to point. Compliance agreements include staff training, treatment practices, self-inspections, monitoring and certification procedures during the critical periods to prevent the accidental movement of an exotic pest to a new area. In the case of PSB, the critical time period is between Nov 1st and June 30th.

In this issue:

The bug

A Eurasian bark beetle, the PSB feed inside new shoots, hollowing them out and killing the shoots. They breed under the bark and can build up in numbers under the right conditions They can feed on any pine, but prefer Scotch pine and only attack other pine when they are in mixed plantings with Scotch pine - and only then, when sanitation practices are lax. However, an outbreak can cause significant shoot damage, stunting and tree decline. An outbreak can also invite in other pests, such as the Ips pine bark beetle.

They are considered a secondary beetle infesting recently cut, dying or severely stressed pine in the spring – hence the association with lax sanitation practices. Young emerge in June and tunnel into the shoots of live trees. Each beetle may kill two to six shoots prior to moving to the base of a tree to over winter. The damaged shoots fade, brown and droop or break off at the base of the tunnel. These 'flags' are the most visible symptom of infestation. There may be several tunnels in one shoot and pitch tubes can occasionally found at the tunnel entry.

The quarantine

Restrictions cover pine nursery and Christmas trees, brush, raw pine products with bark attached and pine wood chips being moved out of or through the three counties between Nov 1st and June 30th. This is the time when the beetles are most likely to be found in the wood and thus easily moved. A brief outline of the regulations are given below, but those in the business are strongly encouraged to contact the MDA directly for further details and any questions. They can be contacted at 651-296-8388. For more information visit www.mda.state.mn.us/invasives/psb/default.htm

Regulations between Nov 1st and June 30th:

- Cut Christmas trees require inspection and fumigation prior to shipment or the grower must be under a compliance agreement.
- Pine nursery stock must be inspected (one infested tree stops the shipment) or the grower must be under a compliance agreement.
- Pine logs and lumber with bark attached must be inspected and fumigated at the point of origin or the receiver must be under a compliance agreement.
- Pine bark mulch of mixed wood chips must be fumigated prior to shipment or shipped under a compliance agreement.
- Shipments beginning and ending outside the quarantined area, but being moved through the quarantined area during the critical period between Nov 1st and June 30th must be transported through without stopping (except for traffic, etc).

Not restricted (although various documents may be required to accompany the shipment):

- Products moved from one part of the quarantined area to another
- Wood and raw wood products moved between July 1st and October 31st
- Processed wood products without bark or wood chips

Those working with contractors and/or growers are encouraged to alert them of the new quarantine and how it may affect them. Those in the business are encouraged to contact the MDA to discuss the terms of a possible compliance agreement. Those not needing to move pine products out of or through the area are advised not to. It's just easier that way and avoids moving other forest pests around as well as the pine shoot beetle.

Potential impacts of pine shoot beetle

When PSB becomes established in Minnesota, we may hardly know it's even here or we may have significant impacts. We can make comparisons of impacts with native insects and with the exotics that are established in neighboring areas, but as exotic insects move into new areas, there is really no way to know for certain what their real impact will be. Here are some scenarios that illustrate how PSB impact might set Minnesota apart from the eastern states where it is rarely a concern.

1. Native bark beetles cause significant mortality losses during droughts in Minnesota compared to eastern states. The western counties of Minnesota are the western most edge of the native ranges of white, red and jack pines in the USA. Here it is dry, average annual rainfall is 20 inches, and even a modest drop in rainfall can precipitate a native bark beetle attack because trees are, in effect, growing in a prairie during the years of a drought.

Entomologists have shown that resins produced in healthy pine trees have the dual action of drowning-out and poisoning bark beetles. Yet, during comparable droughty weather, red pines in Minnesota are more readily attacked by native bark beetles than those in Wisconsin. Dr. Matthew Ayres, Dartmouth, found that, under normal rainfall conditions, resin flow in red pines was twice as high at Itasca State Park as it was at Eau Claire, Wisconsin. Under droughty conditions, Dr. Ayres speculates that this relationship would reverse. The resin defenses at Itasca would be compromised during droughts.

So, our red pines might inherently be more susceptible to exotic bark beetles during droughts because they are inherently more susceptible to native bark beetles.

2. PSB has a different timing of attack than native bark beetles. Pine shoot beetles fly and attack pines at least a month earlier than the native *Ips pini* . This might be important for jack pines because *Ips* bark beetles build up during jack pine budworm outbreaks. In this situation, if jack pine trees are defoliated by jack pine budworm and produce new shoots and needles, the next spring the pines may be able to recover some energy before being attacked by the native bark beetles. If instead, these trees are attacked by PSB before they produce new shoots and needles in the spring and before they have been able to recover from the stress of defoliation, they may suffer higher levels of mortality.

3. As the pine shoot beetle becomes established in Minnesota, they likely will displace some of the native bark beetles. Since PSB emerge one month earlier in the year, they will have used up the available habitat and produced their brood at the expense of the native bark beetles.

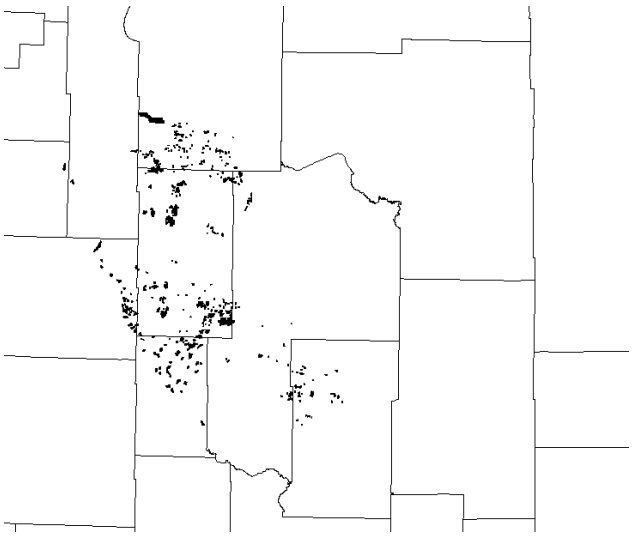
4. Many bark beetles carry blue-stain and other pathogenic fungi. Pine shoot beetle like other bark beetles carry fungi with them. The fungi they carry and their effects on pine trees have not been studied. It is conceivable that these fungi could cause problems with pine tree health.

5. Neighboring states find the most PSB problems in Scots pine growing in abandoned Christmas tree plantations. This is the situation where PSB finds its niche and then can build up and can spread into other species. Unfortunately there is no lack of unattended Scots pine plantations in Minnesota.

There are no simple answers when trying to predict what and how exotics will impact our trees, stands and ecosystems.

Jack pine budworm in 2005?

Last year, 47,700 acres were defoliated by jack pine budworm in Hubbard, Beltrami, Wadena, Becker, Cass and northern Crow Wing Counties. See map. What will happen in 2005? Will this outbreak intensify or will it decline this year? There are two indicators, the pattern set by previous outbreaks and the abundance of egg masses.



The duration of jack pine budworm outbreaks is usually limited by a reaction from the host trees. Typically, a stand will only suffer two years of defoliation because the heavily defoliated trees stop producing staminate cones which are required food for the young caterpillars. If trends from past outbreaks are any indication, then 2004 would be the peak of this outbreak and 2005 should be a declining year.

In Beltrami County, severe defoliation occurred in 2003 and 2004. In 2004, heavy and severe defoliation occurred in Hubbard, Becker and Wadena Counties. Another year of heavy to severe defoliation could befall stands in these counties. However, surveys of egg mass abundance indicate that budworm populations are declining.

County	Number of plots	Percent in 2004 Heavy defoliation	Percent predicted for 2005 Heavy defoliation
Becker	2	100	0
Beltrami	13	54	38
Hubbard	14	77	7

Diplodia study at Itasca State Park

Itasca State Park is having difficulty regenerating red pine in spite of excellent site preparation using prescribed fire on suitable sites with excellent seed sources. Questions remain regarding the influence of animal browse or shrub competition and environmental parameters such as duff depth and amount of light reaching the forest floor. Until this study, no one had looked into the possibility that diseases could be having a deleterious influence on red pine regeneration. From recent studies and surveys elsewhere in Minnesota, we know that *Diplodia sapinea* can have a huge effect on nursery seedlings and the success of outplanted seedlings due to its ability to cause latent infections. Internal water deficits, such as those caused by droughty weather, release latent infections to cause disease symptoms and seedling death.

A study was designed to determine if live, containerized red pine seedlings could be used to "trap" *Diplodia* spores and produce disease symptoms by placing the seedlings under overstory red pine trees. This might indicate the presence and, perhaps, level of *Diplodia* inoculum in the stand.

On May 28th, containerized seedlings were placed in 8 red pine stands and 1 hardwood stand in Itasca State Park. There are no red pine seedlings or saplings in any of the stands. All of the red pine stands are classified as FDc34 in Minnesota's ecological classification scheme.

Blocks of containerized seedlings were produced in a greenhouse and had never been exposed to overstory pines, the predominant source of *Diplodia* inoculum. Two locations in each stand received a half- block containing approximately 90 seedlings. Seedlings were watered and monitored weekly then collected on July 21st. Overall, seedlings broke bud and grew 2 to 3 inches in height during that time and set new buds. Only one half-block was destroyed by bear depredation.

On July 21st, the blocks of seedlings were stored in a sunny garage and watered for one more month. After that they were allowed to dry out, giving the latent infections an impetus to cause disease and produce fruiting structures.

Once the root mass had completely dried out, 50 seedlings were collected from each half block. Each seedling was examined using binocular scopes for the presence of classic shoot blight symptoms, internal stem and root collar symptoms, presence of *Diplodia* pycnidia and other damaging agents. For this report, seedlings that showed internal symptoms of *Diplodia* infection after being drought-stressed will be termed "latently" infected seedlings.

Fallen cones were also collected to provide another determination of the amount of inoculum in the stands. 100 fallen red pine cones were collected in mid-November under the overstory red pines where the seedlings were set out earlier in the year. Efforts were made to collect the youngest, freshest cones. In the lab, each cone was visually inspected for the presence of *Diplodia* infections. Each cone was tallied as either infected or uninfected. Infections were verified by microscopic examination of the pycnidia and spores.

Results: Containerized seedlings exposed to overstory red pine trees for eight weeks in the spring exhibited classic shoot blight symptoms of *Diplodia* infection. Diagnosis was based on external and internal symptoms and by the presence of *Diplodia* pycnidia, when present. The number of blighted seedlings was small, ranging from 3.3 to 10.2%. Using in containerized seedlings, the presence of classic shoot blight symptoms can indicate that *Diplodia* is present in the red pine overstory.

Since all the seedlings were drought stressed to induce latent disease symptoms and sporulation, using internal symptoms was much more descriptive of the true level of infection than was using external symptoms alone. Latent stem infections occurred on an average of 55% of the exposed seedlings (range 25-74%). Most of the latent infections were stimulated to produce internal disease symptoms and, very often, pycnidia. In fact, the production of pycnidia was highly correlated with the presence of internal symptoms on latently infected seedlings ($R = 0.96897$). The levels of classic shoot blight and the levels of latent stem infections from each stand were moderately correlated ($R = 0.7737$).

Three percent latent stem infections were found on the control seedlings. This could be explained by either the use of infected seeds in the greenhouse or by the proximity of several mature red pine trees to the control site (closest

tree was approx. 220 feet). This study couldn't distinguish between these possibilities.

Overall, 48% of the cones were infected by *Diplodia* (range 12-60%). Cone infection levels were only moderately correlated with the shoot blight levels, latent infection levels and the total amount of disease (shoot blight plus internal stem infections). Based on this study, cone infections are not descriptive of the amount of disease in a stand but only show a general trend. However, lower cone infection levels might be used to predict where regeneration may be successful. Further work needs to be done developing the relationship between cones and regeneration success, as there were no stands with less than 12% cone infection in this study.

Conclusions:

1. Containerized seedlings can be used to "bait" *Diplodia* spores in the spring to cause classic shoot blight and latent infections.
2. Latent stem infections in containerized seedlings will produce pycnidia when suitably drought-stressed.
3. At Itasca State Park, shoot blight infections indicate that *Diplodia* inoculum is present in the overstory but shoot blight levels are not a descriptive indicator of disease potential of the overstory stand. Examining the drought-stressed seedlings for internal symptoms of latent infections is a better indicator. This is exactly what we found during surveys of nursery seedbeds in 2003 and 2004. In natural systems, too, latent infections are a more reliable indicator of the disease potential of the overstory stands.
4. *Diplodia* is an important disease of red pine and red pine seedlings in Itasca State Park. Growing red pine seedlings in the understory of mature red pine trees should be considered as having a very, very small chance of success.
5. Further work needs to be done developing the relationship between cone infection and shoot infection, as there were no stands with less than 12% cone infection in this study.

J-rooting and physiological needle root

The attached figure is of a red pine seedling planted in 2001, showing symptoms of physiological needle droop and J-rooting. Approximately 30% of the trees in this plantation suffer from needle droop. The physiological needle droop is associated with trees in the plantation that also have J-rooting deformity.

Physiological needle droop occurs when a combination of factors such as the high air temperatures and low relative humidity of a hot, dry wind on a sunny day causes a high rate of transpiration. This can result in a internal water shortage and the collapse of succulent tissue at the base of current year needles. As in the picture the needles droop over and eventually turn brown. The bend occurs within the needle sheath. This damage can occur in a matter of hours usually in late July to early September. Physiological needle droop occurs only on needles of the current year shoot. After needles have become fully mature they are fully lignified and will not collapse and droop even with a water shortage.

Damage from needle droop can range from only a few current year needles drooping, to the current year shoot and bud being killed or in severe cases entire small trees being killed. Physiological needle droop is most common on young trees and has been reported on trees up to 20 years old.

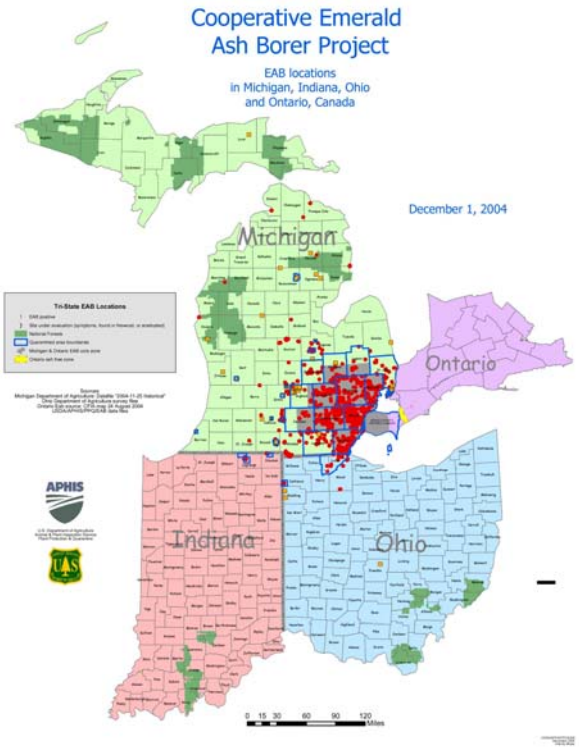
As in this plantation physiological needle droop is often associated with root deformity that occurs at the time of planting such as J-rooting. Root deformity such as J-rooting and root clumping restrict the normal growth of roots reducing the volume of soil they reach which limits their access to soil moisture.

When planting, not only is it important to be sure that the seedlings are planted green side up, but it is also important that the roots are not deformed or clumped. Folded roots have no mechanism to straighten themselves out. If they are wadded up and twisted when planted they will stay that

way for the life of the tree. These trees may live but the deformed roots will reduce their growth and, in times of stress, make them more susceptible to damage from the weather, insects or diseases.

Emerald ash borer: What's at stake?

Roughly six to ten years ago, an exotic wood-boring beetle arrived in southeastern Michigan, probably as a stow-away in wooden crates shipped from Asia. At some point, the emerald ash borers flew off to their favorite food, ash trees. Before the beetle was discovered in the summer of 2002, it had spread to alt least six Michigan counties, one county in Ohio and across the river into Windsor, Canada. In its wake, it left ten million ash trees dead. Since 2002, additional locations in Michigan, Indiana and Maryland



have been found. See map. EAB has cost municipalities, property owners, nursery operators and forest product industries tens of millions of dollars.

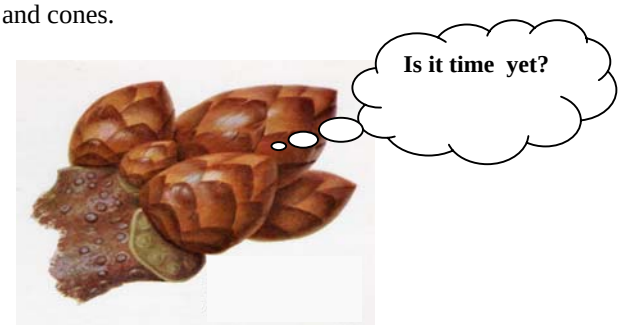
EAB is now firmly established in North America. This is a very aggressive beetle; virtually all ash trees growing in an area where the beetle is known to occur are at risk of dying. One of the efforts to contain the insect is a quarantine aimed at preventing EAB infested materials from moving out of areas in Michigan, Ohio and Indiana where EAB occurs. Under the quarantine, it is illegal to move ash trees, branches, untreated lumber, deciduous firewood and any other materials from these areas unless chipped to one inch or smaller. Additionally, the movement of all ash nursery stock is prohibited within, into, and from the entire Lower Peninsula.

What's at stake in Minnesota? Surprisingly, ash is the fifth most abundant species in our forests (FIA, 2001). The acreage of ash (1,218,000 acres) is comparable to that of oak or birch. At the national level, looking at the abundance of ash and what there is to loose, Minnesota ties for first place with Maine. See map. In our urban forests, ash species and varieties commonly account for 10 to 35% of the trees planted.

In Minnesota, state and federal agencies are teamed up to detect and prevent the establishment of EAB. One of the tasks that will be accomplished this year is to monitor likely entry sites for the presence of EAB including ports of entry, state campgrounds, hardwood mills and tree nurseries.

How do our trees break winter dormancy?

May is the month when our broad-leafed trees break their winter dormancy and begin showing bud growth, green leaves and flowers. Silver maples develop flowers before their leaves appear, but most other tree buds develop leaves. The buds of pines and other evergreens also begin their spring growth in May, adding new shoots, needles and cones.



To prevent destructive frostbite, tree buds are tuned to environmental cues. Exposure to previous winter chilling and freezing temperatures, increasing spring daylight, warming temperatures, inactivation of growth-inhibitor hormones and increase in growth-promoter hormones all play a role in the growth of dormant buds. Such growth varies with the different weather conditions from southern to northern Minnesota, with each species of tree and even with buds on the same tree. Phytochromes react to photoperiod cues and hormones chemically transmit the message that spring has arrived to nearby and distant tissues. Abscisic acid, a growth inhibitor, is gradually inactivated during the spring allowing buds to break dormancy. Growth-promoter hormones include auxins, gibberellins and cytokinins. Their increasing levels cause genes to form enzymes that utilize stored food and increase cell division needed for bud growth.

For many Minnesotans, the spring changes in our trees and in other vegetation are the most welcome and beautiful sights of the entire year.

Tick-borne illnesses

During the growing season, a daily check of your skin for ticks is important, especially if you have spent time in the woods or in grassy areas. The American dog tick and the deer tick are commonly found in Minnesota but they are not easy to distinguish from each other. Deer ticks tend to be smaller, but both species have immature stages, called nymphs, that are pin head-sized. Only the deer ticks have an arched line around the anus on the underside of the abdomen. To see this characteristic, use a strong magnifying lens or a microscope. Note that the arch becomes even more difficult to see if the tick is engorged.

Only the deer tick can convey bacterial or protozoan parasites into your body that cause serious illness. In 2004, there were 1023 recorded cases of Lyme disease in Minnesota, surpassing the record of 867 cases in 2002. Symptoms of Lyme disease include a bull's-eye rash that may have a reddened area with a clear area in the middle. The rash is centerd around the site of the tick bite. A rash may also appear in other places on the body. About 30% of people with Lyme disease never develop a rash. Other symptoms include a fever, headache, chills and muscle and joint pain. Lyme disease can be treated with antibiotics.

Symptoms of erlichiosis, another tick-borne bacterial disease, usually start five to ten days after a person has been bitten, but can take up to a month to appear. Similar to Lyme disease, symptoms include a sudden fever of 102 degrees or more, chills, shaking, fatigue, severe headache, muscle and joint pain, nausea and vomiting, cough, stomach pain and sore throat. It is rare to have a stuffy nose or sinus problem with erlichiosis, which can help distinguish it from the flu. Erlichiosis can be treated with antibiotics.

Babesiosis is caused by a protozoan. Most cases are mild, but can develop into a severe infection and can be fatal, particularly for people who have had their spleen removed or have a suppressed immune system. Symptoms are similar to erlichiosis. Babesiosis can be treated with antibiotics.

The Brainerd Dispatch of May 12, 2005 reported the story of a Crow Wing County deputy who contracted all three illnesses, simultaneously, in 2004. He suffered for months and will have to take antibiotics for the next seven years to ward off other illnesses because his spleen had to be removed. The deputy did not recall finding a tick on his skin. So far in 2005, the hospital in Brainerd has treated three patients with severe babesiosis.

Protection form these tick-borne illnesses involves using skin-repellants, checking clothes worn out-of–doors, checking pets that could carry ticks into the home and prompt removal of ticks from the skin. If the tick is embedded in skin, liberally apply rubbing alcohol to that area then use a fine tweezers to grasp the tick's head and slowly pull it out. Do save the tick for identification, watch for symptoms of illness and consult with your doctor for treatment options.